Operational Testing of Electrocutor Traps for Fly Control in Dining Facilities[1]

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ABSTRACT Operational testing of electrocutor traps, equipped with ultraviolet lamps, was conducted in two dining halls in San Antonio, Tex. Two traps in each facility were turned on during 1 wk, and then off during the next, for an 8-wk period. Insect activity (primarily that of muscoid flies) was monitored by counting number of specimens collected on flypaper, active insects observed on tables and countertops, and specimens collected in the electrocutor traps. More than 200 house flies, *Musca domestica* L., were collected in electrocutor traps during each week that traps were operated. Seventy-two percent fewer house flies were observed when traps were on than when traps were off; more customer complaints about flies were received when traps were off. Populations of other flies and insects were apparently not reduced and even increased in one facility with electrocutors operating. However, as shown by this study, electrocutor traps show promise as pest-management devices in dining facilities.

KEY WORDS *Musca domestica*, Muscidae, Calliphoridae, Sarcophagidae, electrocutor traps

ELECTROCUTOR TRAPS, equipped with ultraviolet (UV) lamps to attract insects, are being used with increasing frequency for pest control. Often, manufacturers of devices designed for outdoor use claim that pests are virtually eliminated from areas where traps are operated. However, this claim has been disproven in tests of units installed in backyards to control mosquitoes (Surgeoner & Helson 1977, Nasci et al. 1983). Mosquito biting activity was greater in yards with traps than in yards without traps. Use of traps indoors has been evaluated under controlled conditions after the release of caged specimens; in those studies, the traps showed promise for reducing flying-insect populations in enclosed spaces.[2] Ultraviolet light traps have also been evaluated for fly control in dairy barns (Pickens et al. 1972, Thimijan et al. 1972, Pickens & Thimijan 1986), and recent investigative efforts have been directed toward design parameters of UV traps that may affect trap performance (Pickens & Thimijan 1986). Additional reports of the effectiveness of electrocutor traps indoors have been in the form of testimonials by satisfied users. To our knowledge, operational tests of traps have not been conducted in dining halls or other food-handling facilities. Therefore, our study was done to determine if a fly problem indoors could be controlled by the use of electrocutor traps.

[1] Mention of a proprietary product in this paper does not constitute an endorsement of the product by the USAF or the Department of Defense.

[2] Weidhaas, W. E., J. P. Hollingsworth, E. G. Thompson & D. F. Davis. 1986. Gilbert-sponsored electrocuting light trap research. Gilbert Research, Jonesboro, Ark.

Materials and Methods

A restaurant manager in San Antonio, Tex., requested assistance in determining the effectiveness of four electrocutor traps (138 by 41 by 12 cm; model 601T, Don Gilbert Industries, Jonesboro, Ark.) he purchased for fly control in dining facilities. Two lamps (Sylvania F40/350 BL) on each trap were powered by 115 V/60 Hz electric current and provided 80 W of output energy. Insect specimens electrocuted by the traps fell into a collection tray at the base of each trap.

Two traps were placed in each of two cafeterias (Fig. 1). Cafeteria A, a 204-m² building, contained a dining area and a kitchen with a serving line and was located in an industrial complex where aircraft were repaired. Cafeteria A was open for business from 0700 to 1300 hours (CDT), during which time the kitchen door remained open to provide ventilation; no screen door was present. A commercial fan device was installed above the kitchen door to provide an air curtain. Although the facility had no windows, it had a glass door at the entrance to the dining area. Cafeteria B, ca. 678 m², comprised a dining area, serving area, and a large kitchen. Cafeteria B was located in an air terminal and was open 24 h/d. The kitchen door, equipped with an air curtain, remained open during daylight hours; no screen door was present. The dining room overlooked the runway, and an entire wall consisted of glass windows that were never opened. Neither facility had double-door entrances.

One trap and four strips of flypaper (2.5 by 75 cm) were installed in each kitchen and each dining area of the two cafeterias. Each trap was mounted

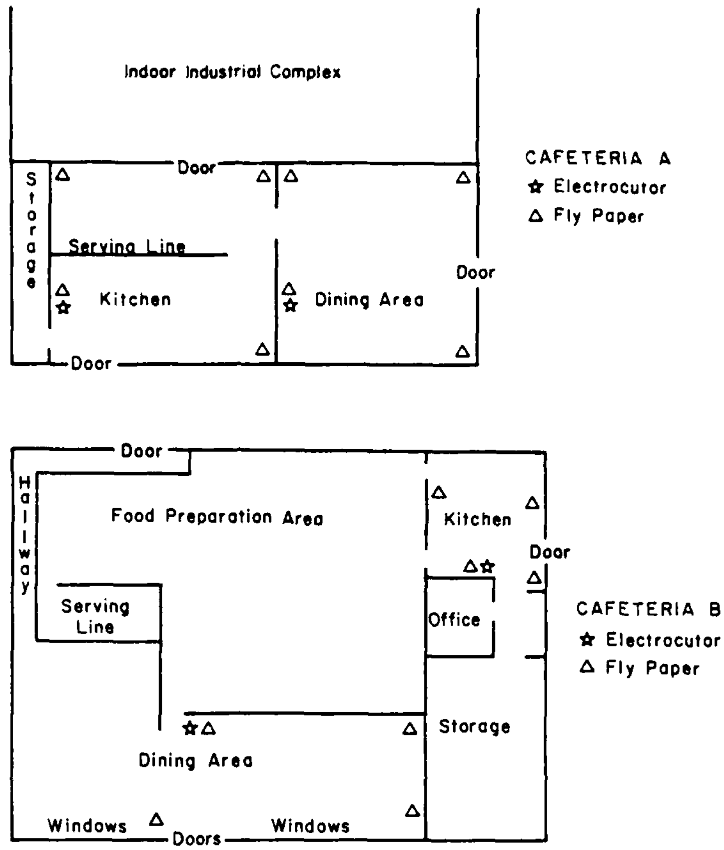

Fig. 1. Location of electrocutor devices and flypaper in two dining facilities used for operational tests in San Antonio, Tex.

on the wall with its long axis perpendicular to the floor and its base ca. 30–40 cm above the floor. The flypaper was also mounted on the wall at approximately the same height as the top of the traps. Six cotton balls were stuck to the flypaper and saturated with fermenting molasses to attract flies (P. B. Morgan, USDA, Gainesville, Fla., personal communication). Flypaper, cotton balls, and molasses were replaced weekly.

Beginning on 8 July 1986, all traps remained on for 7 d and then off for 7 d. This alternation continued for 8 wk. At the end of each week, insects collected on flypaper and in electrocutor traps (when on) were taken to the laboratory and identified. In addition, flies observed on tables and countertops in the kitchen and dining area were counted during a weekly inspection of each cafeteria. One person counted flies in the kitchen while the other counted flies in the dining area. They walked along a predetermined route, counting any flies they observed between the starting and ending points. Inspections were performed each Tuesday at ca. 1000 hours (CDT) in cafeteria A and ca. 1030 hours (CDT) in cafeteria B and required <2 min to complete. The cafeterias were open for business during this procedure. Every effort was made to have the same people inspect the facilities each week; however, this was not always possible because of unexpected travel. Data obtained during weekly inspections were analyzed using χ^2 contingency tables.

When persons arrived to perform weekly inspections, employees informed them of details regarding customer complaints received during the previous week. Employees were unable to maintain an exact count of the number of complaints each week, but the information was useful for assessing public opinion of the devices.

Results

Muscidae, Calliphoridae, Sarcophagidae, and various other insects, including fruit flies (Drosophilidae) and leafhoppers (Homoptera: Cicadellidae), were collected in electrocutor traps (Tables 1 and 2). The house fly, *Musca domestica* L., was the most common species of fly collected in both dining halls. More than 200 individuals of this species were obtained each week that the traps

Table 1. Summary of specimens collected in electrocutor traps over an 8-wk period in cafeteria A

	Flypaper		Inspection		Electrocutor trap	
	Traps on	Traps off	Traps on	Traps off	Traps on	Traps off
M. domestica[a]	0	1	14[b]	55[b]	405	—
P. cuprina	0	0	0	0	13	—
P. sericata	0	0	0	0	5	—
P. mexicana	0	0	0	0	0	—
Sarcophagidae	0	0	0	0	1	—
Other flies[c]	65	66	0	0	141	—
Other insects	7	9	0	0	67	—
Total	72	76	14	55	632	—

[a] Significantly ($\chi^2 = 24.2$; df = 1; $P < 0.01$) more *M. domestica* were observed during inspections when traps were off than when traps were on.
[b] As determined by sight identification.
[c] Predominantly *Drosophila* sp.

were operated, and this was the only species observed on tables and countertops during weekly inspections (as far as could be determined by sight identification). Calliphorids collected in the traps included *Phaenicia cuprina* (Wiedemann), *Phaenicia sericata* (Meigen), and *Phaenicia mexicana* (Macquart).

The number of insect specimens collected on flypaper averaged <25 per week in each dining hall. Fruit flies were commonly collected in this manner in both facilities, whereas leafhoppers were obtained only in cafeteria B. Only seven muscoid flies were captured on 128 strips of flypaper throughout the study.

Fewer flies (72%) were observed during weekly inspections when the traps were on than when the traps were off (Fig. 2). The difference was significant in both cafeteria A ($\chi^2 = 24.2$; df = 1; $P < 0.01$) and cafeteria B ($\chi^2 = 17.1$; df = 1; $P < 0.01$). Also, employees and customers complained more about flies when the traps were not in use. In the two cafeterias, trap effectiveness was similar ($\chi^2 = 0.2$; df = 1; $P > 0.5$) based on the number of flies observed during weekly inspections.

Table 2. Summary of specimens collected in electrocutor traps over an 8-wk period in cafeteria B

	Flypaper		Inspection		Electrocutor trap	
	Traps on	Traps off	Traps on	Traps off	Traps on	Traps off
M. domestica[a]	1	5	14[b]	46[b]	559	—
P. cuprina	1	0	0	0	53	—
P. sericata	0	0	0	0	4	—
P. mexicana	0	0	0	0	1	—
Sarcophagidae	0	0	0	0	4	—
Other flies[c]	44	23	0	0	177	—
Other insects	47	28	0	0	704	—
Total	93	56	14	46	1,502	—

[a] Significantly ($\chi^2 = 17.1$; df = 1; $P < 0.01$) more *M. domestica* were observed during inspections when traps were off than when traps were on.
[b] As determined by sight identification.
[c] Predominantly *Drosophila* sp.

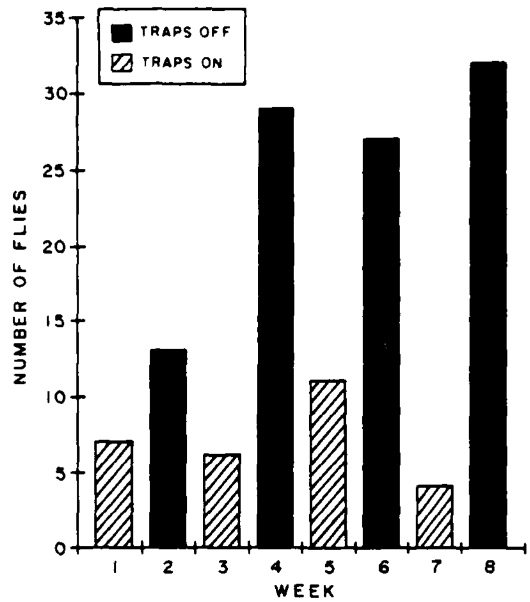

Fig. 2. Number of *M. domestica* observed on tables and countertops during weekly inspections in two dining facilities where electrocutor traps were tested. Seventy-two percent fewer flies were seen during weeks the traps were operated.

Discussion

Results of this study demonstrated that electrocutor traps attract and kill many insects in a dining facility. Because >200 house flies were obtained in the traps each week, we may assume that 200 fewer flies were available to infest the facilities. The blow flies *P. cuprina* and *P. sericata* develop in widely varied decaying meats and vegetables; *P. cuprina* is more likely to be associated with garbage (Hall 1948, Goddard & Lago 1983). All three species could be expected in a food-handling facility and probably breed in decaying matter near the service entrance. Some of the other insects collected in this study (e.g., stored-product pest beetles and fruit flies) could also be expected in dining facilities.

The number of insects collected on flypaper was about equal in cafeteria A regardless of trap condition (Table 1). In contrast, nearly twice as many insects were collected by the same method in cafeteria B (the one with large glass windows overlooking a runway) when traps were on than when traps were off (Table 2). This result may be due to a poor choice of trap location that allowed insects in the runway area to see the trap's UV light. Once attracted into the cafeteria, the insects were available for collection on the flypaper. This possibility

has important ramifications in that improper placement of traps may actually increase the problem with some insects.

Fly counts made during weekly inspections were better than flypaper for monitoring the fly population; however, drawbacks of the inspection procedure included the inability to identify flies to species accurately and the possibility of counting individuals more than once. In this study, the fact that specimens could easily be recognized as filth flies outweighed the importance of identification to species, and the low numbers present each week (<18) reduced the likelihood of counting individuals more than once.

Employee and customer complaints were more prevalent when traps were turned off and during one such wk a customer in cafeteria A reported the fly problem to the facility pest-control personnel. Control was not implemented at that time because food was exposed and our evaluation was in progress. Even though some flies were present when traps were on, customers seemed reassured of fly control by the operating traps. Personnel in the dining halls were evidently not disturbed by the electrocutor traps. Weidhaas et al.,[3] in their review of pertinent literature, found that the traps did not emit hazardous levels of UV light or ozone. Because the traps meet standards established by Underwriters' Laboratories,[4] no electrical or mechanical hazards exist when used according to the manufacturer's instructions.

A 72% reduction in the number of flies observed during weekly inspections when traps were on (Fig. 2) was less than the 89–97% reduction reported by Weidhaas et al.,[3] but experimental methods for the two studies were quite different: Weidhaas et al. released a known quantity of flies into empty buildings with all doors closed. Perhaps a greater reduction would have occurred during our study if the kitchen doors had been closed, but we instructed employees to conduct business as usual so that we could determine the effectiveness of the traps under actual conditions in the two cafeterias.

[3] Weidhaas, W. E., E. G. Thompson & J. P. Hollingsworth. 1985. Industrial-type electrocuting light traps: an assessment of present technology and industry utilization. Don Gilbert Industries, Jonesboro, Ark.

[4] Underwriters' Laboratories. 1982. Insect-control equipment, electrocution-type, UL 1559. Standard for safety.

When faced with the dilemma of how to handle a fly infestation, managers of food-handling facilities should consider a program that integrates sanitation, nonchemical control, and chemical control. Open doors in the kitchens of both cafeterias in this study probably contributed significantly to the fly infestation. Such obvious discrepancies should be corrected as part of a pest-management program in dining facilities. Sanitation and building maintenance are the keys to prevention. However, as shown in our study, electrocutor traps are a useful element in the overall program.

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